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TECHNICAL INFORMATION

LIME

FOR MASONRY MORTAR

UNITED STATES GYPSUM
The Greatest Name in Building

GENERAL OFFICES—300 WEST ADAMS STREET, CHICAGO 6, ILLINOIS

1957

MASONRY MORTAR

BASIC REQUIREMENTS OF GOOD MASONRY MORTARS

Good masonry walls are expected to be water and weather resistant, and durable with a minimum of maintenance. The essential factors in obtaining such results are:

1. Good Masonry Units—with rate of water absorption (suction), neither too high nor too low.

2. Good Workmanship—Full joints.

3. Good Mortar—which is readily placeable and provides complete and uniform bond with the units by virtue of its high plasticity and water retentivity. It must be durable, weather resistant, possess adequate strength, and be economical.

Assuming a satisfactory masonry unit, then good workmanship and good mortar are so closely allied that neither can be sacrificed without jeopardizing the required results.

FUNCTION OF LIME IN GOOD MASONRY MORTAR

A good lime, mixed in the proper proportion with portland cement, proper sand, and water, imparts the following required characteristics to masonry mortar:

Plasticity—Lime is both a cementitious and a plasticizing agent. With a given cement and sand, the plasticity of the resulting mortar will vary with the plasticity of the lime. A highly plastic lime is essential to ready placeability of the mortar for well filled joints and water resistant walls. Plasticity is measured by the Emley Plasticimeter. The higher reading enhances the desirable characteristics.

Water Retentivity—Water retentivity is the ability of mortar to resist suction of the building units. A good lime imparts high water retentivity to the mortar. Mortars of high water retentivity bond more uniformly to masonry units before hardening, minimize need for retempering, thereby producing more water resistant joints and minimizing danger of efflorescence. A.S.T.M. mortar specifications require 70 per cent minimum "flow after suction" of mortar as delivered to the mason.

Adequate Strength—Strength of mortar should conform to A.S.T.M. requirements. **High lime content mortars possess adequate strength for all normal building requirements.**

Low Cost—

(a) Mortars having the above characteristics are conducive to rapid, easy, economical, and neat workmanship.

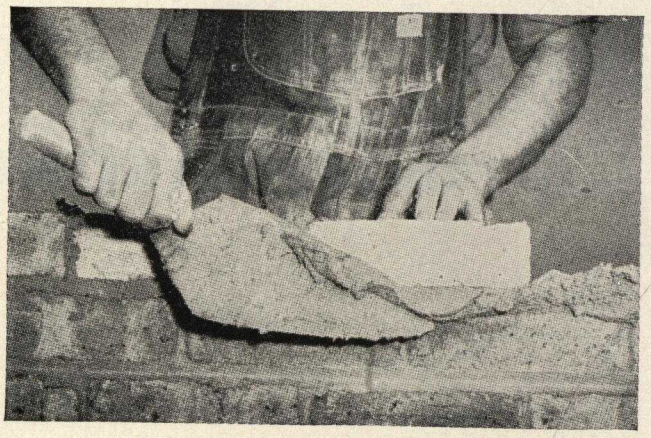
(b) Minimum droppings—Minimum mortar waste.

(c) Low maintenance cost.

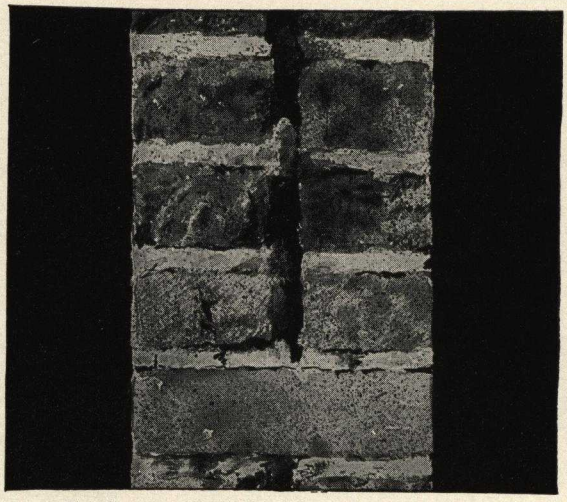
(d) Mortars are proportioned on a volume basis. A 50 lb. bag of hydrated lime contains approximately 1¼ cubic feet. A mortar mix of one bag of portland cement, two bags of lime and nine cubic feet of sand (1:2½:9) is one of the most economical mortars complying with the characteristics described above.

"MORTASEAL"* and "RED TOP"* are registered trademarks owned by United States Gypsum and are used by it to distinguish its products. "MORTASEAL" identifies the particular hydrated lime; "RED TOP" identifies the particular hydrate or high calcium quicklime and other building products manufactured only by United States Gypsum.

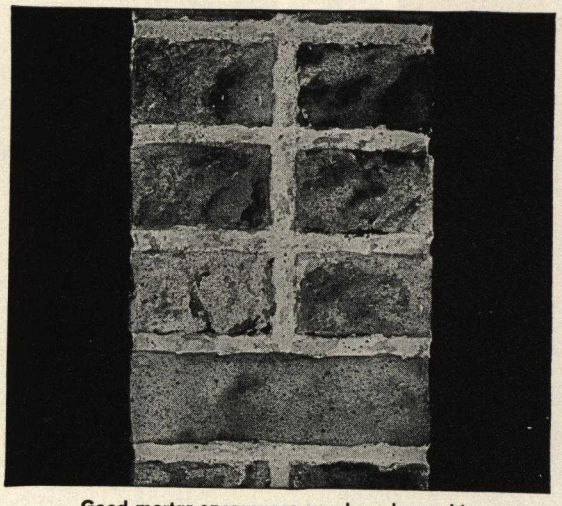
A good mortar spreads easily and resists suction of brick.



A plastic mortar flows with light pressure and encourages good workmanship.



Harsh mortar is conducive to poor workmanship and unfilled joints.



Good mortar encourages good workmanship and well filled joints.

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LIME FOR MASONRY MORTAR

MORTASEAL*

DESCRIPTION

MORTASEAL (Genoa, Ohio Mill) is a double hydrated Ohio dolomitic lime, and MORTASEAL (Farnams, Mass. Mill) is a quick-soaking, hydrated, high calcium lime (both less than 8 per cent unhydrated oxides). They meet the following specifications: A.S.T.M. C207-49, Type S; Federal Specifications SS-L-351, Type M, (also Type F though not designated as a finishing lime), including the added requirement of not more than 8% unhydrated oxides; National Lime Association Type S.

FUNCTION AND UTILITY

MORTASEAL lime qualifies most readily with all "Functions of Lime in good Masonry Mortar" described on preceding page as follows:

Plasticity—MORTASEAL develops exceptional plasticity and workability immediately upon mixing with water—either by machine or by hand. Emley Plasticity of MORTASEAL is 250 to 400. This permits a mortar of exceptional working qualities that is conducive to good workmanship and water resistant joints.

Eliminates soaking or slaking of lime.

High Water Retentivity—Mortar mixes of 1:2½:9 with MORTASEAL lime, as shown in data table, produced the unusually high "flow after suction" (resistance to suction) of 93 per cent.

(a) Facilitates better filling of masonry joints regardless of high or uneven suction.

(b) Conducive to a more complete, strong, uniform bond with masonry units.

(c) Decreases need for retempering.

Low Volume Change—Because of the 92 per cent hydration of MORTASEAL, volume change due to "unsound" material is negligible.

Ease of Mixing—MORTASEAL lime requires no soaking or slaking; is placed in mixer in dry state, direct from containers.

ADEQUATE STRENGTH: A 1:2½:9 mix of portland cement, MORTASEAL and sand complied with A.S.T.M. strength requirements for Type N mortar (750 pounds per square inch at 28 days). See Data below.

Lower in Cost because:

(a) No soaking or slaking required.

(b) High sand-carrying capacity.

(c) Minimum labor required to mix or apply.

(d) Less need to retemper.

(e) Less need to wet masonry units.

(f) A 1:2½:9 MORTASEAL mix is one of the lowest cost mortars.

AVAILABILITY

Available east of the Rocky Mountains.

LIMITATIONS OF USE

None.

MASONRY MORTAR DATA

SPECIFICATIONS FOR MORTAR FOR UNIT MASONRY

REQUIREMENTS OF ASTM DESIGNATION C270-54T						AVERAGE TEST RESULTS USING USG LIMES						
Standards / Mortar Types	Property Specifications		Proportion Specification			Job Mixes on Volume Basis	MORTASEAL		Red Top Masons Hydrate		Red Top Masons Quicklimes	
	Minimum Aver. Comp. Strength psi 28 Days	Flow After Suction Percent Minimum	Portland Cement (1)	Lime (2)	Sand (3)		Compressive Strength psi (4)	% Flow After (4) Suction	Compressive Strength psi (4)	% Flow After (4) Suction	Compressive Strength psi (4)	% Flow After (4) Suction
M (A-1)	2500	70	1	¼	2.8 to 3¾	1:¼:3¾	4924	69.0	4277	62.8	Not Tested	66.7
S (A-2)	1800	70	1	¼ to ½	2.8 to 4½	1:½:4½	3154	70.4	← Not Tested →			
N (B)	750	70	1	½ to 1¼	3.4 to 6¾	1:1¼:6	2150	80.6	1953	77.2	1420	87.5
						1:1¼:6¾	1750	78.0	← Not Tested →			
O (C)	350	70	1	1¼ to 2½	5.1 to 10½	1:2½:9	916	93.3	853	85.6	550	89.0
						1:2½:10½	663	78.0	← Not Tested →			
K (D)	75	70	1	2½ to 4	7.9 to 15	1:4:15	203	88.3	110	80.6	Not Tested	82.0

Mortar type designations in parentheses are former type designations in effect prior to 1954.

CONCLUSIONS:

A 1:½:4½ mortar with MORTASEAL complied with Type M Property Specifications.

A 1:1¼:6 mortar with MORTASEAL or RED TOP Masons Hydrate complied with Type S Property Specifications.

A 1:2½:9 mortar with MORTASEAL or RED TOP Masons Hydrate complied with Type N Property Specifications.

NOTES:

(1) PORTLAND CEMENT—To comply with ASTM Designation C150, Type I, II or III; or ASTM Designation C175, Type 1A, IIA, or IIIA.

(2) LIME—To comply with ASTM Designation C5 (Quicklime) or ASTM Designation C207 (Hydrated) Type N or S.

(3) SAND AGGREGATE—To comply with ASTM Designation C144 and to be not less than 2¼ and not more than 3 times the sum of the volumes of the cement and lime used, measured in a damp and loose condition.

(4) Based on mortars as delivered to mason having initial flows between 100 and 115%.

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LIME FOR MASONRY MORTAR

RED TOP* MASONS HYDRATED LIME

DESCRIPTION

A normal hydrated lime, either dolomitic (less than 92 per cent hydration) or high calcium, for use in masonry mortar. Conforms with A.S.T.M. C207-49, Type N; Federal SS-L-351, Type M; National Lime Association Type N.

FUNCTION AND UTILITY

Plasticity—Properly soaked masons hydrated lime has an Emley Plasticity of 150-200, sufficiently high to be conducive to water resistant joints and easy-working mortar.

Water Retentivity—"Flow after suction" with a 1:1¼:6 and 1:2½:9 mix was found to exceed 70 per cent, adequate to insure a mortar of good bonding strength and adhesion and of sufficient workability to permit complete filling of joints. A 70 per cent value complies with ASTM standard minimum property requirement for water retentivity.

Low Volume Change.

Adequate Strength.

AVAILABILITY

Nationwide.

LIMITATIONS

1. Must be soaked overnight to develop maximum plasticity.

RED TOP MASONS QUICKLIME

DESCRIPTION

RED TOP high calcium quicklime is manufactured in both pulverized or pebble form. Conforms with A.S.T.M. C5-26; Federal Specifications SS-Q-351.

FUNCTION AND UTILITY

Properly slaked and aged, yields a putty which greatly enhances:

(a) Plasticity (300-500 Emley).

(b) Water retentivity approximately 85 per cent obtained for a 1:2½:9 mix.

(c) Workability for water resistant walls.

High Yield—Produces over 50 per cent more putty volume than hydrated lime.

Adequate Strength.

LIMITATIONS

1. For best results, quicklime must be of recent manufacture to avoid air slaking in container.
2. Must be handled carefully to avoid burning.
3. Extra slaking and aging time and equipment required.
4. Must be properly slaked and aged.

SPECIFICATIONS

(The following are offered as desirable inclusions in any masonry specification, and are not intended as a complete section covering Masonry Specifications.)

GENERAL PROVISIONS

All masonry materials shall be heated to a temperature such that they will remain above 35° F. until they have been placed and suitably protected.

Masonry shall be protected against freezing for at least 48 hours after placing. Unless such precautions against freezing are taken, no masonry shall be built when temperature is below 32° F. on a rising temperature, or below 40° F. on a falling temperature. No masonry shall be laid on walls that are frozen or contain frost.

MORTAR MATERIALS

Lime—shall be: (*select one*)

(MORTASEAL)

(RED TOP Masons Hydrated Lime)

(RED TOP Masons Quicklime)
manufactured by United States Gypsum Company.

Portland Cement—shall conform to (Federal Specification SS-C-192 Type 1) (ASTM C150-47 Type 1).

Sand—shall conform to Specifications for Aggregate for Masonry Mortar, ASTM C144-44.

Water—used in mixing mortar shall be clean and free from deleterious amounts of acids, alkalies or organic materials.

LIME PREPARATION (*select one*)

(MORTASEAL shall be mixed without soaking or slaking.)

(RED TOP *Masons Hydrated Lime* shall be soaked at least 16 hours before using.)

(RED TOP *Masons Quicklime* shall be slaked and aged for at least 16 hours, or until the putty temperature is 80° F. or less.)

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MORTAR MIX

1. Above Grade—Mortar made from materials complying with the above specifications shall be mixed in proportion of one bag portland cement, two bags lime (or two and one half cubic feet quicklime putty), to not more than nine cubic feet sand (1:2½:9).

2. Below Grade—Mortar made from materials complying with these specifications shall be mixed in proportion of one bag portland cement, one bag lime (or one and one quarter cubic feet quicklime putty), to not more than six cubic feet of sand (1:1¼:6).

3. Specialized Uses—

(a) For extra-strength, reduce proportion of sand (i.e. 1:2½:8 or 1:1¼:5, but not less than 1:2:6¾ or 1:1:4½).

(b) For extreme strength or under excessive moisture conditions, reduce lime content (viz. 1:1/4:3).

(c) For glass block, use 1:1:5 mix.

(d) For power plant chimneys, use 1:2:5 mix.

(e) For ceramic tile, use 1:1:6 mix.

(f) For gypsum tile, use one part RED TOP Partition Tile Cement and three parts sand by weight.

WORKMANSHIP

Note to Architect: Detailed workmanship specifications will vary, depending on type of job and building units involved. However, it is suggested that on all masonry work, the following be incorporated:

1. Mortar shall be laid in a uniform bed without furrows and all joints shall be completely filled. Sufficient mortar shall be placed in mortar beds and in head and collar joints to completely fill all spaces between masonry units.

2. Highly absorbent brick shall be wetted (not *soaked*) before laying.

3. Mortar materials shall be accurately proportioned and thoroughly mixed. Retempering with additional water shall be kept to a minimum. Mortar which has been mixed for more than 2 hours shall be discarded.

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